



wwPDB X-ray Structure Validation Summary Report ⓘ

Mar 5, 2026 – 07:27 AM UTC

PDB ID : 3BRS / pdb_00003brs
Title : Crystal structure of sugar transporter from Clostridium phytofermentans
Authors : Malashkevich, V.N.; Patskovsky, Y.; Toro, R.; Meyers, A.J.; Wasserman, S.; Sauder, J.M.; Burley, S.K.; Almo, S.C.; New York SGX Research Center for Structural Genomics (NYSGXRC)
Deposited on : 2007-12-21
Resolution : 2.00 Å(reported)

This is a wwPDB X-ray Structure Validation Summary Report for a publicly released PDB entry.

We welcome your comments at validation@mail.wwpdb.org

A user guide is available at

<https://www.wwpdb.org/validation/2017/XrayValidationReportHelp>

with specific help available everywhere you see the ⓘ symbol.

The types of validation reports are described at

<http://www.wwpdb.org/validation/2017/FAQs#types>.

The following versions of software and data (see [references ⓘ](#)) were used in the production of this report:

MolProbity	:	4-5-2 with Phenix2.0
Xtriage (Phenix)	:	2.0
EDS	:	3.0
Percentile statistics	:	20250101.v01 (using entries in the PDB archive January 1st 2025)
CCP4	:	9.0.010 (Gargrove)
Density-Fitness	:	1.0.12
Ideal geometry (proteins)	:	Engh & Huber (2001)
Ideal geometry (DNA, RNA)	:	Parkinson et al. (1996)
Validation Pipeline (wwPDB-VP)	:	2.49

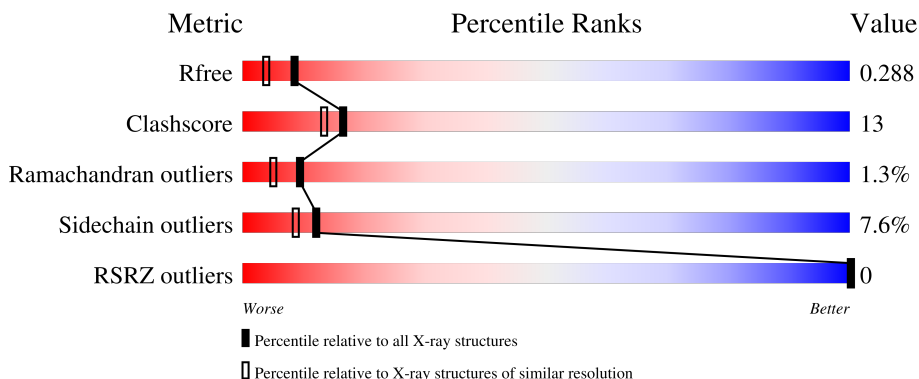
1 Overall quality at a glance

The following experimental techniques were used to determine the structure:

X-RAY DIFFRACTION

The reported resolution of this entry is 2.00 Å.

Percentile scores (ranging between 0-100) for global validation metrics of the entry are shown in the following graphic. The table shows the number of entries on which the scores are based.



Metric	Whole archive (#Entries)	Similar resolution (#Entries, resolution range(Å))
R_{free}	180053	10052 (2.00-2.00)
Clashscore	190562	11152 (2.00-2.00)
Ramachandran outliers	187476	11031 (2.00-2.00)
Sidechain outliers	187428	11029 (2.00-2.00)
RSRZ outliers	180081	10067 (2.00-2.00)

The table below summarises the geometric issues observed across the polymeric chains and their fit to the electron density. The red, orange, yellow and green segments of the lower bar indicate the fraction of residues that contain outliers for ≥ 3 , 2, 1 and 0 types of geometric quality criteria respectively. A grey segment represents the fraction of residues that are not modelled. The numeric value for each fraction is indicated below the corresponding segment, with a dot representing fractions $\leq 5\%$. The upper red bar (where present) indicates the fraction of residues that have poor fit to the electron density. The numeric value is given above the bar.

Mol	Chain	Length	Quality of chain
1	A	289	 63% 25% 6% • 6%
1	B	289	 61% 28% • • 6%

2 Entry composition [i](#)

There are 2 unique types of molecules in this entry. The entry contains 4477 atoms, of which 0 are hydrogens and 0 are deuteriums.

In the tables below, the ZeroOcc column contains the number of atoms modelled with zero occupancy, the AltConf column contains the number of residues with at least one atom in alternate conformation and the Trace column contains the number of residues modelled with at most 2 atoms.

- Molecule 1 is a protein called Periplasmic binding protein/LacI transcriptional regulator.

Mol	Chain	Residues	Atoms					ZeroOcc	AltConf	Trace
1	A	271	Total	C	N	O	S	0	1	0
			2108	1344	334	417	13			
1	B	271	Total	C	N	O	S	0	0	0
			2104	1340	333	418	13			

There are 22 discrepancies between the modelled and reference sequences:

Chain	Residue	Modelled	Actual	Comment	Reference
A	1	MET	-	expression tag	UNP Q1FMG2
A	2	SER	-	expression tag	UNP Q1FMG2
A	3	LEU	-	expression tag	UNP Q1FMG2
A	282	GLU	-	expression tag	UNP Q1FMG2
A	283	GLY	-	expression tag	UNP Q1FMG2
A	284	HIS	-	expression tag	UNP Q1FMG2
A	285	HIS	-	expression tag	UNP Q1FMG2
A	286	HIS	-	expression tag	UNP Q1FMG2
A	287	HIS	-	expression tag	UNP Q1FMG2
A	288	HIS	-	expression tag	UNP Q1FMG2
A	289	HIS	-	expression tag	UNP Q1FMG2
B	1	MET	-	expression tag	UNP Q1FMG2
B	2	SER	-	expression tag	UNP Q1FMG2
B	3	LEU	-	expression tag	UNP Q1FMG2
B	282	GLU	-	expression tag	UNP Q1FMG2
B	283	GLY	-	expression tag	UNP Q1FMG2
B	284	HIS	-	expression tag	UNP Q1FMG2
B	285	HIS	-	expression tag	UNP Q1FMG2
B	286	HIS	-	expression tag	UNP Q1FMG2
B	287	HIS	-	expression tag	UNP Q1FMG2
B	288	HIS	-	expression tag	UNP Q1FMG2
B	289	HIS	-	expression tag	UNP Q1FMG2

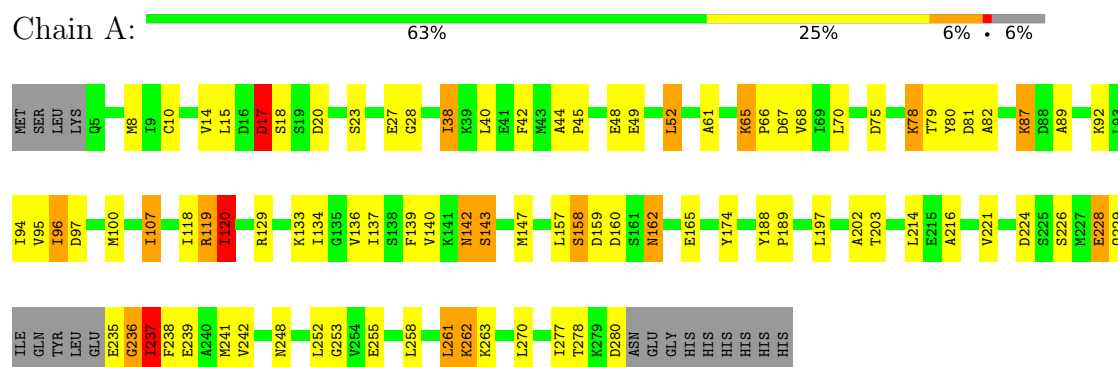
- Molecule 2 is water.

Mol	Chain	Residues	Atoms		ZeroOcc	AltConf
2	A	131	Total 131	O 131	0	0
2	B	134	Total 134	O 134	0	0

3 Residue-property plots

These plots are drawn for all protein, RNA, DNA and oligosaccharide chains in the entry. The first graphic for a chain summarises the proportions of the various outlier classes displayed in the second graphic. The second graphic shows the sequence view annotated by issues in geometry and electron density. Residues are color-coded according to the number of geometric quality criteria for which they contain at least one outlier: green = 0, yellow = 1, orange = 2 and red = 3 or more. A red dot above a residue indicates a poor fit to the electron density ($RSRZ > 2$). Stretches of 2 or more consecutive residues without any outlier are shown as a green connector. Residues present in the sample, but not in the model, are shown in grey.

- Molecule 1: Periplasmic binding protein/LacI transcriptional regulator



- Molecule 1: Periplasmic binding protein/LacI transcriptional regulator



4 Data and refinement statistics

Property	Value	Source
Space group	P 1 21 1	Depositor
Cell constants a, b, c, α , β , γ	68.62Å 54.70Å 90.24Å 90.00° 111.78° 90.00°	Depositor
Resolution (Å)	19.68 – 2.00 19.68 – 2.00	Depositor EDS
% Data completeness (in resolution range)	99.2 (19.68-2.00) 97.2 (19.68-2.00)	Depositor EDS
R_{merge}	0.11	Depositor
R_{sym}	(Not available)	Depositor
$\langle I/\sigma(I) \rangle$ ¹	1.69 (at 1.99Å)	Xtriage
Refinement program	REFMAC	Depositor
R, R_{free}	0.203 , 0.283 0.210 , 0.288	Depositor DCC
R_{free} test set	2122 reflections (5.00%)	wwPDB-VP
Wilson B-factor (Å ²)	33.2	Xtriage
Anisotropy	0.174	Xtriage
Bulk solvent k_{sol} (e/Å ³), B_{sol} (Å ²)	0.35 , 42.4	EDS
L-test for twinning ²	$\langle L \rangle = 0.48$, $\langle L^2 \rangle = 0.31$	Xtriage
Estimated twinning fraction	0.379 for h,-k,-h-l	Xtriage
F_o, F_c correlation	0.96	EDS
Total number of atoms	4477	wwPDB-VP
Average B, all atoms (Å ²)	37.0	wwPDB-VP

Xtriage's analysis on translational NCS is as follows: *The largest off-origin peak in the Patterson function is 7.72% of the height of the origin peak. No significant pseudotranslation is detected.*

¹Intensities estimated from amplitudes.

²Theoretical values of $\langle |L| \rangle$, $\langle L^2 \rangle$ for acentric reflections are 0.5, 0.333 respectively for untwinned datasets, and 0.375, 0.2 for perfectly twinned datasets.

5 Model quality

5.1 Standard geometry

The Z score for a bond length (or angle) is the number of standard deviations the observed value is removed from the expected value. A bond length (or angle) with $|Z| > 5$ is considered an outlier worth inspection. RMSZ is the root-mean-square of all Z scores of the bond lengths (or angles).

Mol	Chain	Bond lengths		Bond angles	
		RMSZ	$\# Z > 5$	RMSZ	$\# Z > 5$
1	A	1.61	22/2136 (1.0%)	1.47	16/2874 (0.6%)
1	B	1.59	17/2129 (0.8%)	1.49	17/2864 (0.6%)
All	All	1.60	39/4265 (0.9%)	1.48	33/5738 (0.6%)

Chiral center outliers are detected by calculating the chiral volume of a chiral center and verifying if the center is modelled as a planar moiety or with the opposite hand. A planarity outlier is detected by checking planarity of atoms in a peptide group, atoms in a mainchain group or atoms of a sidechain that are expected to be planar.

Mol	Chain	#Chirality outliers	#Planarity outliers
1	A	0	3
1	B	0	1
All	All	0	4

The worst 5 of 39 bond length outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(Å)	Ideal(Å)
1	A	139	PHE	CA-C	8.31	1.56	1.52
1	B	137	ILE	C-O	7.96	1.32	1.24
1	A	137	ILE	C-O	7.86	1.32	1.24
1	B	95	VAL	CA-CB	-7.61	1.44	1.54
1	A	134	ILE	CA-CB	7.39	1.64	1.54

The worst 5 of 33 bond angle outliers are listed below:

Mol	Chain	Res	Type	Atoms	Z	Observed(°)	Ideal(°)
1	A	158	SER	CB-CA-C	-10.68	104.24	116.63
1	B	134	ILE	CA-C-N	-8.45	114.38	122.66
1	B	134	ILE	C-N-CA	-8.45	114.38	122.66
1	A	134	ILE	CA-C-N	-8.39	116.21	122.33
1	A	134	ILE	C-N-CA	-8.39	116.21	122.33

There are no chirality outliers.

All (4) planarity outliers are listed below:

Mol	Chain	Res	Type	Group
1	A	17	ASP	Peptide
1	A	236	GLY	Peptide
1	A	237	ILE	Peptide
1	B	159	ASP	Peptide

5.2 Too-close contacts [i](#)

In the following table, the Non-H and H(model) columns list the number of non-hydrogen atoms and hydrogen atoms in the chain respectively. The H(added) column lists the number of hydrogen atoms added and optimized by MolProbity. The Clashes column lists the number of clashes within the asymmetric unit, whereas Symm-Clashes lists symmetry-related clashes.

Mol	Chain	Non-H	H(model)	H(added)	Clashes	Symm-Clashes
1	A	2108	0	2159	54	0
1	B	2104	0	2148	57	0
2	A	131	0	0	8	0
2	B	134	0	0	6	0
All	All	4477	0	4307	110	0

The all-atom clashscore is defined as the number of clashes found per 1000 atoms (including hydrogen atoms). The all-atom clashscore for this structure is 13.

The worst 5 of 110 close contacts within the same asymmetric unit are listed below, sorted by their clash magnitude.

Atom-1	Atom-2	Interatomic distance (Å)	Clash overlap (Å)
1:B:8:MET:HG2	1:B:68:VAL:CG2	1.68	1.20
1:B:8:MET:HG2	1:B:68:VAL:HG22	1.19	1.14
1:B:119:ARG:HG2	1:B:119:ARG:HH11	1.23	1.02
1:A:87:LYS:HG3	2:A:376:HOH:O	1.60	1.01
1:B:8:MET:CG	1:B:68:VAL:CG2	2.41	0.99

There are no symmetry-related clashes.

5.3 Torsion angles [i](#)

5.3.1 Protein backbone [i](#)

In the following table, the Percentiles column shows the percent Ramachandran outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries

of similar resolution.

The Analysed column shows the number of residues for which the backbone conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Favoured	Allowed	Outliers	Percentiles	
1	A	268/289 (93%)	252 (94%)	13 (5%)	3 (1%)	11	7
1	B	267/289 (92%)	244 (91%)	19 (7%)	4 (2%)	8	4
All	All	535/578 (93%)	496 (93%)	32 (6%)	7 (1%)	9	5

5 of 7 Ramachandran outliers are listed below:

Mol	Chain	Res	Type
1	B	237	ILE
1	B	236	GLY
1	A	160	ASP
1	A	228	GLU
1	B	6	TYR

5.3.2 Protein sidechains ⓘ

In the following table, the Percentiles column shows the percent sidechain outliers of the chain as a percentile score with respect to all X-ray entries followed by that with respect to entries of similar resolution.

The Analysed column shows the number of residues for which the sidechain conformation was analysed, and the total number of residues.

Mol	Chain	Analysed	Rotameric	Outliers	Percentiles	
1	A	230/246 (94%)	213 (93%)	17 (7%)	13	9
1	B	229/246 (93%)	211 (92%)	18 (8%)	11	8
All	All	459/492 (93%)	424 (92%)	35 (8%)	12	9

5 of 35 residues with a non-rotameric sidechain are listed below:

Mol	Chain	Res	Type
1	B	184	LEU
1	B	217	LYS
1	B	268	LYS
1	A	261	LEU
1	A	235	GLU

Sometimes sidechains can be flipped to improve hydrogen bonding and reduce clashes. 5 of 9 such

sidechains are listed below:

Mol	Chain	Res	Type
1	B	126	ASN
1	B	244	GLN
1	A	162	ASN
1	A	198	ASN
1	A	248	ASN

5.3.3 RNA [i](#)

There are no RNA molecules in this entry.

5.4 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

5.5 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

5.6 Ligand geometry [i](#)

There are no ligands in this entry.

5.7 Other polymers [i](#)

There are no such residues in this entry.

5.8 Polymer linkage issues [i](#)

There are no chain breaks in this entry.

6 Fit of model and data [i](#)

6.1 Protein, DNA and RNA chains [i](#)

In the following table, the column labelled ‘#RSRZ> 2’ contains the number (and percentage) of RSRZ outliers, followed by percent RSRZ outliers for the chain as percentile scores relative to all X-ray entries and entries of similar resolution. The OWAB column contains the minimum, median, 95th percentile and maximum values of the occupancy-weighted average B-factor per residue. The column labelled ‘Q< 0.9’ lists the number of (and percentage) of residues with an average occupancy less than 0.9.

Mol	Chain	Analysed	<RSRZ>	#RSRZ>2	OWAB(Å ²)	Q<0.9
1	A	271/289 (93%)	-1.21	0 100 100	15, 34, 56, 70	1 (0%)
1	B	271/289 (93%)	-1.17	0 100 100	22, 34, 55, 78	0
All	All	542/578 (93%)	-1.19	0 100 100	15, 34, 56, 78	1 (0%)

There are no RSRZ outliers to report.

6.2 Non-standard residues in protein, DNA, RNA chains [i](#)

There are no non-standard protein/DNA/RNA residues in this entry.

6.3 Carbohydrates [i](#)

There are no oligosaccharides in this entry.

6.4 Ligands [i](#)

There are no ligands in this entry.

6.5 Other polymers [i](#)

There are no such residues in this entry.